Claims

1. Biodegradable, phase separated multiblock copolymer, comprising segments of a soft biodegradable prepolymer (A) having a Tg lower than 37°C; and segments of a hard biodegradable prepolymer (B) having a Tm of 40-100°C, the segments being linked by a multifunctional chain-extender.

2. Copolymer according to claim 1, wherein said chain-extender is an aliphatic chain-extender.

3. Copolymer according to claim 1 or 2, wherein prepolymer (A) comprises ester and/or carbonate groups, optionally in combination with polyethers.

4. Copolymer according to any of the previous claims, wherein a polyether is present as an additional prepolymer.

5. Copolymer according to claims 2-4, wherein pre-polymer (A) comprises reaction products of ester forming monomers selected from diols, dicarboxylic acids and hydroxycarboxylic acids.

6. Copolymer according to any of the previous claims, wherein prepolymer (A) comprises reaction products of cyclic monomers and/or non-cyclic monomers.

7. Copolymer according to claim 6, wherein said cyclic monomers are selected from glycolide, lactide (L, D or L/D), ε-caprolactone, δ-valerolactone trimethylene carbonate, tetramethylenecarbonate, 1,5-dioxepane-2-one, 1,4-dioxane-2-one (*para*-dioxanone)and/or cyclic anhydrides such as oxepane-2,7-dione.

8. Copolymer according to claim 5 or 6, wherein said non-cyclic monomers are selected from succinic acid, glutaric acid, adipic acid, sebacic acid, lactic acid, glycolic acid, hydroxybutyric acid, ethylene glycol, diethyleneglycol, 1,4-butanediol and/or 1,6-hexanediol.

9. Copolymer according to claim 2-8, wherein said polyethers are selected from PEG (polyethylene glycol), PEG-PPG (polypropylene glycol), PTMG (polytetramethyleneether glycol) and combinations thereof.

10. Copolymer, according to any of the previous claims, in particular a copolymer having a random monomer distribution, wherein prepolymer (A) is prepared by a ring-opening polymerisation initiated by a diol or di-acid compound.

11. Copolymer according to claim 9, wherein PEG is an initiator with a molecular weight of 150-4000, preferably of 150-2000, more preferably of 300-1000.

12. Copolymer according to any of the previous claims, wherein prepolymer (B) is prepared by a ring-opening polymerisation initiated by a diol or di-acid compound.

13. Copolymer according to any of the previous claims, wherein prepolymer (B) contains a crystallisable amount of ε-caprolactone, δ-valerolactone, para-dioxanone, polyhydroxyalkanoate, aliphatic polyanhydride. .

14. Copolymer according to claim 13, wherein pre-polymer (B) is poly-ε-caprolactone.

15. Copolymer according to claim 14, wherein pre-polymer (B) has a Mn of larger than 1000, preferably larger than 2000, more preferably larger than 3000.

16. Copolymer according to claim 14 or 15 wherein the content of prepolymer (B) is 10-90 wt.% preferably 30-50 wt.%.

17. Copolymer according to any of the previous claims, having an intrinsic viscosity of at least 0.1 dl/g, and preferably between 1-4 dl/g.

18. Process for preparing a copolymer according to any of the previous claims, comprising a chain extension reaction of prepolymer (A) and prepolymer (B) in the presence of a suitable aliphatic chain extender, whereby a randomly segmented multi-block copolymer is obtained.

19. Process according to claim 18, wherein said chain extender is a difunctional aliphatic molecule.

20. Process according to claim 19, wherein said difunctional aliphatic molecule is a diisocyanate, preferably butanediisocyanate.

21. Process for preparing a copolymer according to any of the claims 1-17, comprising a coupling reaction, wherein pre-polymers A and B are both diol or diacid terminated and the chain-extender is di-carboxylic acid or diol terminated, respectively, using a coupling agent.

22. Process according to claim 21, wherein the coupling agent is dicyclohexyl carbodiimide (DCC).

23. Process for preparing a copolymer according to any of the claims 1-17, comprising a coupling reaction, wherein a BAB-prepolymer is made by reacting a prepolymer (A) with monomers which form prepolymer (B), thus obtaining a BAB-tri-block prepolymer, which is subsequently chain-extended using a multifunctional chain-extender.

24. Process for preparing a copolymer according to any of the claims 1-17, comprising a coupling reaction, wherein a ABA-prepolymer is made by reacting a pre-polymer (B) with monomers that form prepolymer (A), thus obtaining an ABA-tri-block pre-polymer, which is subsequently chain-extended using a multifunctional chain-extender .

25. Process according to any of the previous claims 18-24, wherein said chain-extender is selected from diisocyanate (preferably butanediisocyanate), di-carboxylic acid or diol, optionally in the presence of a coupling agent.

26. Use of a copolymer according to claim 1-17 or the copolymer obtainable by the process of claim 18-25 as an implant or in drug delivery.

27. Sponge, implant, nerve guide, meniscus prosthesis, film, foil, sheet, drug eluting coatings, membrane, plug, coating or micro-spheres comprising a copolymer according to claim 1-17 or the copolymer obtainable by the process of claim 18-25.

28. Sponge according to claim 24 having a porosity of 50-99%.